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Weekly Bulletin



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LOS ANGELES

State Office Building, 217 West First
Street Madison 1271

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GUY P. JONES
EDITOR

Schick Tests and Antitoxin Levels Among Children in Santa Barbara County

R. C. MAIN, M.D., Health Officer, and ELIZABETH WOOD, Laboratory Technician, Santa Barbara County Health Department

Purpose:

The present study was undertaken:

1. To determine if possible the immunity to diphtheria, as measured by the Schick test, existing in a random sample of school children in Santa Barbara County;
2. To compare this immunity with the antitoxic content of the blood serum;
3. To determine the diphtheria carrier incidence among school children;
4. To determine the incidence of lues in school children by means of blood Kline tests checked by blood Kolmer Wassermann tests.

Plan:

The Guadalupe, Betteravia and Bonita schools provided a good random sample of the school population of the county, since the percentage of diphtheria immunized children in these schools (as in others) was high, and since this group provided a fair sampling of three major racial groups—Japanese, Mexican and white Americans. Their accessibility from the laboratory also made these three schools desirable.

This inquiry was carried on by Elizabeth Wood, technician of the County Health Department laboratory, with the assistance of Peter Cohen, M.D., and Elsie Thompson, P.H.N., of the health department,

and Harold Kahn, M.D., of the Santa Maria Hospital. Trips were made by them to these schools about twice a week during the period from January 3 to March 8, 1937. Each of the 626 children in these schools was given a letter explaining the reasons for doing the tests and also a form for the parents to sign, requesting that the child be tested. Four hundred and two signed requests were returned to the schools. The students were then dealt with in groups of 20 to 30 at each school visit of the staff.

Procedure:

As each child entered the room where the testing was done, his signed request slip was numbered and attached to a history sheet bearing the same number. From that time on all tests were read and records handled, using only the numbers for purposes of identification.

For the sake of convenience, and also in order that the results of the Schick test might not influence the antitoxin titrations, the tests were done in the following order: (1) Nose and throat cultures were taken with sterile cotton swabs and the swabs were immediately placed on properly numbered slants of Loeffler's blood serum media. (2) Next a venipuncture was done and the blood was aseptically transferred to sterile vials also properly numbered. (3) Lastly, each child was Schick tested with freshly diluted Schick

toxin—.1 cc containing 1/50 MLD diphtheria toxin (#3782) was injected intradermally on the flexor surface of the left forearm. Immediately afterwards .1 cc of heated toxin (3782.2) was injected similarly into the right forearm to serve as a control in reading the Schick tests. Cultures and bloods were then promptly returned to the laboratory.

As soon as possible after reaching the laboratory the swabs were well wiped over the surface of the media; the swabs were then discarded and the Loeffler's slants were incubated over night at 37° C. The next day smears were made from each slant, stained with acetic toluidine blue, and examined microscopically for the presence of *C. diphtheriae*.

The vials containing the blood were stored in the ice box over night to allow time for clot retraction. The next day the blood serum was removed aseptically and stored in the ice box in properly labeled tubes. Because there was not sufficient time to titrate the serum during the period when the specimens were being collected and the Schick tests run, the serum samples were stored until the entire number was collected. Diphtheria antitoxin titrations were run on each serum in the approximate order in which they had been collected. Each serum was titrated according to the intradermal rabbit method of Claus Jensen. Because of the time, labor and expense involved, only the first titration, 9 dilutions of serum, was run. It was felt that, for our purposes, this first titration, which gave readings from .005 AE/cc to 1.6 AE/cc was sufficiently accurate. A control row of ten intradermal tests, containing constant quantities of the standard antitoxin and slightly varied amounts of the established test dose of diphtheria toxin, was run on each rabbit to be used in correcting the unknown serum titrations tested on that rabbit. This control row was necessary because of the variability of the reagents used and because of the differences in sensitivity to diphtheria toxin of different rabbits' skins. It was possible to test from twelve to twenty-five sera on one rabbit.

Schick tests and controls were read at the end of forty-eight hours for the first reading, and after an interval of one week the tests were read again. The period of seven days was allowed to give ample time for pigment formation to take place. The results of the Schick tests were recorded on each child's numbered history sheet at the time the tests were read. Throughout the project one person gave and read all the Schick tests, so as to reduce, as much as possible, the error due to personal judgment.

Some weeks later a Kline test was done on each serum if there was sufficient serum left after the rab-

bit titrations were run. A child having a positive Kline test on the serum which had been stored was bled again and the fresh serum used in this laboratory to run another Kline test to check the original; and serum from the second blood specimen was sent to the State Bureau of Laboratories for a Kolmer Wassermann test.

Results and Discussion:

Throat Cultures: It was interesting to note that in such a highly immunized group of school children there were no diphtheria carriers found by the methods employed. A large number (approximately 30%) of the children were found to be harboring the diphtheria *C. hoffmani* (see Table I). The percentage of throat cultures positive for streptococci was much higher in the American group, approximately 16%, as compared with the other racial groups. With this exception the morphology of the nose and throat flora was remarkably constant for all of the racial groups. This would seem to indicate that the throat and nose flora is dependent chiefly upon contact and school association rather than upon racial characteristics. There appeared to be no significant variations in the nose and throat culture findings at various age levels.

Schick Tests and Antitoxin Titrations: Of the entire group of 402 children there were only five who had never received an immunizing agent (toxin-antitoxin, alum precipitated toxoid or formol toxoid). Ninety-six, including the five not treated, or 23.9%, were found to be Schick positive reactors. Because it was impossible to obtain blood specimens on some children and because a few specimens were contaminated, antitoxin titrations were run on only 385 sera out of the entire group of 402 children. The positive Schick threshold as expressed in antitoxic units per cc was found to be in the neighborhood of .018 or .02. This figure for the Schick threshold is considerably higher than the threshold reported by Schick (.005 antitoxin units per cc). However, it falls within the range found by other workers. Kolmer and Mashag found .05 antitoxin units per cc necessary to give a negative Schick. Kellogg and Stevens found the threshold to be .01 antitoxin units; and in 1923 the Medical Council of Great Britain established the Schick threshold at between .017 and .025 antitoxin units per cc. The number of positive Schicks in such a highly immunized group was somewhat larger than one would expect to find and may be related to the high threshold established by our procedures.

An attempt was made to compare the proportions of positive Schick results in the three groups receiving the different types of immunizing agent; although

there was wide difference in lengths of time elapsing since the various methods of immunizing were employed (Table II). Since second titrations were not run on the sera falling into the very low and very high categories on the first titration, it is impossible to take averages of antitoxin titers for the various groups arranged according to age, race and immunizing agent. However it is interesting to note that the modes of antitoxin per cc for the variously immunized groups differ quite markedly. The mode of those children immunized with alum precipitated toxoid was found to be .09 AE/cc as compared to .1 AE/cc for those receiving toxin-antitoxin, and .16 AE/cc for those receiving formol toxoid. The percentage of positive Schick reactors was much higher among the Japanese (35.5%) than in any other racial group. As a result of so many individuals in this group falling into the lower levels of the antitoxin titers the mode of the AE/cc for the Japanese was found to be .055 as compared with .18 to .2 AE/cc for the American, .12 to .16 for the Mexican, and .09 for the "others" group. Apparently the Japanese do not respond to antigenic stimulation as well as the white Americans and Mexicans. There were no significant differences in the percentage of positive Schick reactors found at different age levels, although the highest percentage of positive Schick tests and low antitoxin titers were found in the middle age group (7 to 8 and 9 to 10 years). The five who had never been immunized, had positive Schicks and .099 or less AE/cc.

In reading the Schick tests, fairly high percentages of protein and questionable reactions were found at the forty-eight hour reading. The protein and pseudo reactions do not appear to be limited to any one antitoxic level, though they are more common in those children with low antitoxic content. 36.8% and 28.9% of the questionable reactions (a combined percentage of 65.7% of all the questionable reactions noted) occurred in the toxin-antitoxin and alum precipitated toxoid immunized group respectively, which together comprised approximately 46% of the entire number of children immunized (Table III). Over half (59.2%) of all the protein reactions noted in reading the Schick tests at forty-eight hours occurred in the toxin-antitoxin immunized group, which comprised only 28.8% of the children tested. This might be the result of the protein sensitization resulting from the use of toxin-antitoxin as an immunizing agent (Table III).

Kline and Wassermann Tests: In some instances, after the antitoxin titrations were done, there was insufficient serum left to run Kline tests. A total of

378 Kline tests were run on sera which had been stored in the refrigerator for a period of approximately two months. Of this number six were definitely positive and seven were doubtful positives. Five of the children in the group of thirteen were bled again and the freshly drawn serum was used at once for Klines, with Wassermanns run simultaneously at the State Bureau of Laboratories. On the second Kline tests, checked by Kolmer Wassermann tests, none were found to be positive. These results would seem to indicate that Kline tests on old sera are not reliable.

Summary:

1. A total of 402 children (397 immunized) in the Guadalupe, Betteravia and Bonita Schools were Schick tested and throat cultured.
2. On 385 of this group diphtheria antitoxin titrations were run on the blood sera.
3. Kline tests were run on 378 of these sera after storage for two months. Positive reactors were bled again and checked by immediate Kline tests and Kolmer Wassermann tests.
4. No diphtheria carriers were discovered in the group used for the survey.
5. 23.9% of the total group of children, ranging in age from two to sixteen years, and comprised chiefly of white Americans, Japanese, and Mexicans, were positive Schick reactors.
6. The Schick positive threshold was found to be between .18 AE/cc and .02 AE/cc.
7. The Japanese appeared to have a lower grade of immunity to diphtheria than any other racial group.
8. Questionable Schick reactions appeared to be associated with low antitoxin levels in the blood serum. Protein reactions appeared independent of the blood antitoxic level.
9. Formol toxoid immunized children appeared, on the average, to have developed a higher antitoxic level than alum precipitated toxoid or toxin-antitoxin immunized children.
10. Kline tests done on old blood sera were found to be unreliable.

(Continued in next issue)

FOOD PRODUCTS DESTROYED

Considerably more than 100 tons of dried fruits, in December, were destroyed by the Bureau of Food and Drug Inspection because of their unfitness for human consumption. In addition, considerable quantities of sub-standard wine were distilled, since the product was unfit for consumption as wine. None of these products was destroyed until every effort had been made to salvage it for human consumption.

MORBIDITY**Complete Reports for Following Diseases for Week Ending
January 29, 1938****Chickenpox**

681 cases: Alameda County 2, Alameda 6, Albany 2, Berkeley 14, Livermore 1, Oakland 57, Piedmont 3, San Leandro 2, Gridley 2, Colusa County 5, Contra Costa County 3, El Cerrito 2, Placerville 2, Fresno County 35, Fresno 10, Sanger 1, Glenn County 2, Imperial County 3, Calexico 9, El Centro 1, Kern County 18, Kings County 2, Hanford 7, Lake County 2, Los Angeles County 23, Alhambra 1, Azusa 1, Beverly Hills 2, Covina 1, Glendale 9, Huntington Park 1, Inglewood 1, Long Beach 22, Los Angeles 96, Montebello 1, Pasadena 1, Pomona 1, Santa Monica 10, South Pasadena 1, Torrance 2, Hawthorne 8, South Gate 6, Monterey Park 1, Signal Hill 2, Bell 1, Madera County 5, Madera 1, Chowchilla 4, San Rafael 1, Merced County 4, Gustine 1, Monterey County 2, Orange County 9, Santa Ana 2, Placentia 2, Tustin 2, Roseville 1, Riverside County 9, Corona 2, Riverside 2, Sacramento 2, Redlands 2, San Bernardino 2, San Diego County 4, Coronado 5, Escondido 8, La Mesa 4, San Diego 21, San Francisco 39, San Joaquin County 19, Lodi 1, Stockton 6, Tracy 1, San Luis Obispo County 4, Paso Robles 1, San Luis Obispo 6, San Mateo County 1, Burlingame 4, Redwood City 1, San Mateo 2, Menlo Park 3, Santa Barbara County 15, Lompoc 7, Santa Barbara 13, Santa Maria 14, Santa Clara County 1, Gilroy 1, San Jose 11, Santa Cruz 2, Redding 2, Solano County 3, Fairfield 1, Stanislaus County 6, Modesto 2, Tehama County 1, Red Bluff 2, Exeter 2, Lindsay 2, Sonora 3, Ventura County 21, Santa Paula 2, Ventura 3, Yolo County 2.

Diphtheria

32 cases: Oakland 1, El Cerrito 1, El Centro 1, Kings County 3, Los Angeles County 1, Los Angeles 3, Pomona 1, Redondo 1, Santa Monica 1, Merced County 2, Monterey County 1, Orange County 1, Placentia 1, Riverside County 5, San Diego 4, San Francisco 2, Stanislaus County 2, Yuba City 1.

German Measles

21 cases: Berkeley 2, Fresno County 3, Selma 1, Los Angeles 3, Pomona 1, Lynwood 1, Signal Hill 1, Orange County 1, Riverside County 1, Ontario 1, San Francisco 3, Stockton 1, Santa Clara County 1, Santa Cruz 1.

Influenza

180 cases: Oakland 3, Fresno County 3, Calexico 1, Kern County 32, Kings County 3, Hanford 1, Los Angeles County 1, Culver City 1, El Monte 1, Glendale 1, Long Beach 2, Los Angeles 20, Monrovia 1, Pasadena 1, San Gabriel 1, South Gate 1, Chowchilla 2, Mendocino County 31, Grass Valley 3, Nevada City 33, Orange County 1, Anaheim 2, Fullerton 4, Santa Ana 1, Riverside County 1, Riverside 4, Sacramento 13, San Francisco 5, Red Bluff 7.

Malaria

3 cases: Los Angeles County 1, San Francisco 1, California 1.*

Measles

176 cases: Emeryville 1, Oakland 2, El Dorado County 1, Fresno County 2, Fresno 1, Kern County 19, Taft 1, Kings County 24, Hanford 7, Los Angeles County 2, Alhambra 1, Glendale 1, Long Beach 1, Los Angeles 10, Pomona 1, Whittier 1, Madera County 5, San Rafael 2, Merced County 12, Monterey County 2, Orange County 1, Santa Ana 1, Riverside County 4, Ontario 1, Escondido 1, San Diego 6, San Francisco 1, San Joaquin County 2, Stanislaus County 6, Sutter County 1, Tehama County 1, Exeter 8, Tulare 1, Visalia 45, Ventura 1.

Mumps

446 cases: Alameda County 1, Berkeley 1, Emeryville 4, Oakland 63, Piedmont 3, Colusa County 1, Colusa 2, Contra Costa County 8, Fresno County 22, Fresno 5, Sanger 1, Kern County 2, Tehachapi 33, Los Angeles County 7, Claremont 1, El Segundo 2, Glendale 13, Long Beach 30, Los Angeles 12, Pasadena 2, Pomona 4, South Gate 2, Madera County 42, Madera 11, Ukiah 1, Napa 3, Orange County 2, Anaheim 1, Santa Ana 1, Placer County 1, Roseville 23, Corona 1, Riverside 1, Sacramento 9, San Diego County 24, Escondido 3, La Mesa 1, National City 2, San Diego 8, San Francisco 18, San Joaquin County 4, Lodi 1, San Luis Obispo County 4, San Luis Obispo 1, San Mateo County 2, Santa Barbara County 7, Lompoc 1, Santa Barbara 6, Santa Maria 8, Santa Clara County 4, San Jose 2, Santa Cruz County 1, Santa Cruz 5, Vallejo 1, Sonoma County 3, Santa Rosa 1, Stanislaus County 8, Oakdale 12, Ventura County 2, Yolo County 1, Yuba County 1.

Lobar Pneumonia

133 cases: Berkeley 1, Fresno County 5, Eureka 2, Imperial County 1, Bakersfield 1, Kings County 1, Los Angeles County 13, Glendale 1, Glendora 1, Long Beach 1, Los Angeles 51, Monrovia 2, Pomona 2, San Gabriel 1, Santa Monica 3, Sierra Madre 1, Torrance 1, South Gate 2, Bell 2, Mendocino County 9, Calistoga 1, Anaheim 1, Santa Ana 1, Sacramento County 4, Sac-

ramento 6, San Diego 1, San Francisco 11, San Joaquin County 1, Santa Maria 1, Shasta County 1, Yreka 2, Corning 1, Visalia 1.

Scarlet Fever

235 cases: Alameda County 1, Alameda 1, Berkeley 2, Emeryville 2, Oakland 10, Chico 1, Gridley 1, El Cerrito 2, Fresno County 8, Fresno 2, Humboldt County 1, Fortuna 1, Calexico 1, Kern County 4, Bakersfield 3, Delano 2, Kings County 4, Hanford 4, Los Angeles County 26, Alhambra 2, Arcadia 1, Compton 1, Long Beach 3, Los Angeles 44, Pasadena 2, Redondo 1, San Fernando 1, Santa Monica 3, Torrance 2, Lynwood 2, Maywood 3, Gardena 2, Chowchilla 2, Ukiah 3, Merced County 1, Monterey County 2, Grass Valley 2, Orange County 3, Orange 1, Santa Ana 1, Laguna Beach 1, Riverside 2, Sacramento County 2, Ontario 1, San Diego County 2, La Mesa 2, National City 3, San Diego 1, San Francisco 10, San Joaquin County 12, Lodi 4, Stockton 1, San Luis Obispo 2, San Mateo County 1, Daly City 1, Redwood City 2, Santa Barbara County 1, Santa Maria 2, Santa Clara County 3, Gilroy 1, Palo Alto 1, Shasta County 3, Redding 2, Benicia 2, Petaluma 1, Stanislaus County 1, Modesto 1, Sutter County 1, Yuba City 1, Exeter 1, Lindsay 3, Tulare 1, Sonora 1, Ventura County 1, Santa Paula 1, Ventura 1, California 1.*

Smallpox

35 cases: Imperial County 5, Brawley 6, Imperial 1, Westmoreland 1, Kings County 8, Los Angeles County 2, Los Angeles 4, Santa Monica 5, San Francisco 1, Tuolumne County 1, Sonora 1.

Typhoid Fever

7 cases: Albany 1, Imperial County 2, Los Angeles 1, Redondo 1, Shasta County 1, California 1.*

Whooping Cough

415 cases: Alameda County 1, Berkeley 14, Emeryville 4, Oakland 15, El Cerrito 5, Fresno County 3, Fresno 3, Eureka 1, Imperial County 1, Inyo County 1, Bishop 1, Kern County 7, Lake County 2, Los Angeles County 12, Alhambra 2, Huntington Park 1, La Verne 3, Long Beach 2, Los Angeles 16, Manhattan 1, Monrovia 4, Pasadena 7, Redondo 1, San Fernando 2, Santa Monica 2, Whittier 2, Lynwood 1, Madera County 5, Madera 1, San Rafael 2, Yosemite National Park 3, Merced County 3, Monterey County 2, Monterey 1, Salinas 3, Santa Ana 4, Seal Beach 5, Roseville 24, Corona 1, Riverside 1, Sacramento 47, San Diego County 1, Escondido 4, La Mesa 4, National City 7, San Diego 59, San Francisco 45, San Joaquin County 24, Stockton 10, San Luis Obispo County 3, Paso Robles 2, San Luis Obispo 1, Daly City 2, San Mateo 2, Santa Clara County 3, Palo Alto 1, San Jose 3, Fairfield 7, Suisun 1, Oakdale 3, Ventura County 3, Ventura 2, Davis 1, Yuba County 1.

Meningitis (Epidemic)

One case: San Francisco.

Dysentery (Amoebic)

One case: Sunnyvale.

Dysentery (Bacillary)

3 cases: Los Angeles County 1, Sacramento 1, Modesto 1.

Ophthalmia Neonatorum

One case: Los Angeles.

Pellagra

2 cases: Los Angeles County 1, San Francisco 1.

Poliomyelitis

3 cases: Brawley 1, Kings County 1, Redding 1.

Trachoma

2 cases: Orange County 1, San Francisco 1.

Paratyphoid Fever

2 cases: San Bruno 1, Tulare 1.

Trichinosis

4 cases: Berkeley 2, Sacramento 1, Santa Rosa 1.

Food Poisoning

5 cases: San Francisco.

Undulant Fever

4 cases: Los Angeles County 1, Santa Barbara County 1, San Jose 1, Marysville 1.

Rabies (Animal)

42 cases: Fresno County 2, Kern County 4, Los Angeles County 8, Glendale 5, Los Angeles 14, Pasadena 3, Santa Monica 1, South Gate 1, Merced County 1, Ventura County 3.

* Cases charged to "California" represent patients ill before entering the state or those who contracted their illness traveling about the state throughout the incubation period of the disease. These cases are not chargeable to any one locality.